WHAT IS CLAIMED IS:

1. An embeddable corrosion rate meter (ECRM) comprising:

a working electrode whose corrosion rate is being measured;

electronics circuits that receive power from an outside power source;

a programmable electric current signal-generating device;

a data transmitter;

a cell with a metal electrode that reacts or corrodes minimally; and

an electronic identification (ID), wherein said ECRM is encapsulated in an aggregate-size, inert container, not bigger than about 2 cm in diameter, and about 1 cm in height.

2. An embeddable corrosion rate meter (ECRM) system for detecting and measuring corrosion in metal structures, said system comprising:

at least one working electrode evenly separated from a counter electrode, wherein a separation distance between said at least one working electrode and said counter electrode determines an electrolyte medium resistance, said electrolyte medium resistance is less than or equal to a polarization resistance;

a signal generator for generating a current source, said current source is connected to a plurality of resistances for creating a plurality of current amplitudes;

a first selector for applying current through each of said plurality of resistances to said at least one working electrode and said counter electrode, wherein said current is applied via a galvanostat;

a second selector for selecting a duration of a current pulse;

a programmable electronic chip having a voltage output, wherein said chip is programmed to include a voltage-time signal, said voltage-time signal including a plurality of sine waves;

said galvanostat for receiving and converting said voltage output into a current-time perturbation signal;

a voltmeter/A-D converter for measuring polarization of said working electrode, wherein said voltmeter has an input impedance greater than 10^9 ohms;

an external reader-head with a data link and power link connected to said computer for powering said system and extracting corrosion measurements data via said data link; and

at least one computing device for receiving said corrosion measurements data and performing analysis to measure corrosion in said metal structures.

3. The system of Claim 2, further comprising an electronic radio-frequency ID for identification of said ECRM.

4. An embeddable system for detecting and measuring corrosion in a structure susceptible to corrosion, said system including a plurality of embeddable corrosion rate meters (ECRM) for collecting corrosion measurements data and at least one computing device for analyzing said corrosion measurements, said system comprising:

at least one working electrode evenly separated from a counter electrode, wherein a separation distance between said at least one working electrode and said counter electrode determines an electrolyte medium resistance, said electrolyte medium resistance is less than or equal to a polarization resistance;

a signal generator for generating a current source, said current source is connected to a plurality of resistances for creating a plurality of current amplitudes;

a first selector for applying current through each of said plurality of resistances to said at least one working electrode and said counter electrode, wherein said current is applied via a galvanostat; and

an external reader-head with a data link and power link connected to said computing device for powering said ECRM and transferring corrosion measurements data via said data link.

5. The system of Claim 4, wherein said ECRM is between about 1 to about 5 centimeters in diameter and between about 0.2 to about 1 centimeters in height.

6. The system of Claim 4, wherein said counter electrode is separated from said at least one working electrode by holder material.

7. The system of Claim 4, wherein said working electrode is made from the same material as the structure being detected for corrosion.

8. The system of Claim 7, wherein the material is a metal selected from the group consisting of iron, carbon steel, stainless steel, super alloy steel, copper, zinc, aluminum, titanium, and alloys and combinations thereof.

9. The system of Claim 4 wherein the structure is a rebar, storage tank, chamber, duct, tube or composite material.

10. The system of Claim 4, wherein said counter electrode is made from a non-corroding inert material.

11. The system of Claim 4, wherein the non-corroding inert material is selected from the group consisting of titanium oxide and ruthenium oxide, graphite, dimensionally stable palladium-coated titanium, and steel.

12. The system of Claim 4, further comprising:

a second selector for selecting the duration of a current pulse; and,

a voltmeter/A-D converter for measuring polarization of said working electrode, wherein said voltmeter has an input impedance greater than 10^9 ohms.

13. The system of Claim 4, wherein said corrosion measurements data is used for graphing a plot of I_j vs. $(V_p)_j$, with OCV as the origin and estimating a slope of the plot of I_j vs. $(V_p)_j$, wherein said slope provides the value of the polarization resistance, R_p, which is inversely proportional to the corrosion rate.

14. The system of Claim 4, wherein said corrosion measurements data is obtained by disconnecting said galvanostat from said working electrode and said counter electrode and measuring a voltage difference between said working electrode and said counter electrode.

15. The system of Claim 14, wherein said measurement is performed by setting a variable j to 0, where j is an integer value from 0 to n.

a) incrementing j and setting a current pulse amplitude to I_j, wherein amplitudes for current pulses are in the ± 0.1 to ± 10 μA range;

b) starting a 1 ms current pulse at pre-set amplitude and measuring said voltage difference between working electrode and said counter electrode, storing said difference as 1 ms closed circuit voltage ($CCV_{@1ms}$) between said working electrode and said counter electrode for the 1 ms current pulse at set amplitude I_j;

c) starting a 500 ms current pulse at pre-set amplitude and measuring said voltage difference between working electrode and said counter electrode, storing said difference 500 ms closed circuit voltage ($CCV_{@500ms}$) between said working electrode and said counter electrode for the 500 ms current pulse at set amplitude I_j, wherein a difference between $CCV_{@1ms}$ and $CCV_{@500ms}$ provides $(V_p)_j$;

d) repeating steps b-c for current amplitude values of I_2 through I_j, as well as at $-I_1$, through $-I_j$, and estimating the value of $(V_p)_j$ for each I_j value.

16. The system of Claim 4, further comprising:

a programmable electronic chip having a voltage output, wherein said chip is programmed to include a voltage-time signal, said voltage-time signal including a plurality of sine waves; and

said galvanostat for receiving and converting said voltage output into a current-time perturbation signal.

17. The system of Claim 4, further comprising a unique electronic radio-frequency ID for identification of said ECRM.

18. A method for detecting and measuring corrosion in a structure susceptible to corrosion, said corrosion being detected by a plurality of embeddable corrosion rate meters (ECRM) and analyzed by at least one computing device, said method comprising the steps of:

determining an electrolyte medium resistance using a separation distance between at least one working electrode and said counter electrode, said at least one working electrode evenly separated from a counter electrode, wherein a electrolyte medium resistance being less than or equal to a polarization resistance;

generating a current source connected to a plurality of resistances for creating a plurality of current amplitudes;

applying a current from a first selector through each of said plurality of resistances to said at least one working electrode and said counter electrode, wherein said current is applied via a galvanostat;

selecting via a second selector, a duration of a current pulse;

measuring polarization of said working electrode using a voltmeter/A-D converter, wherein said voltmeter has an input impedance greater than 10^9 ohms; and

powering said system via a power link connected to an external reader-head and collecting corrosion measurements data via a data link connected to said external reader-head, wherein said external reader-head is connected to said computing device.

19. The method of Claim 18, further comprising the steps of:

generating a voltage output for voltage-time signal including a plurality of sine waves, wherein said voltage output is produced by a programmable electronic chip; and

receiving and converting in a galvanostat said voltage output into a current-time perturbation signal.

20. The method of Claim 19, further comprising the step of emitting a unique electronic radio-frequency ID for identification of said ECRM.

21. The method of Claim 18, wherein the structure is a rebar, storage tank, chamber, duct, tube or composite material.

22. The method of Claim 18, wherein the structure is a metal selected from the group consisting of iron, carbon steel, stainless steel, super alloy steel, copper, zinc, aluminum, titanium, and alloys and combinations thereof.